MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

DCS5158 – COMPUTER ARCHITECTURE

(DIT)

9 MARCH 2019
9:00 a.m. – 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT:

1. This question paper consists of **FIVE** pages.
2. **SECTION A**: Answer **ALL** questions. Please shade your answers on the OMR sheet provided.
3. **SECTION B**: Answer **ALL** questions. Please write your answers in the answer booklet provided.

SECTION A: MULTIPLE CHOICE QUESTIONS (MCQ) (10 Marks)

Instruction: *Answer **ALL** questions in this section. Shade your answers on the OMR sheet provided.*

1. Which component of the CPU is responsible for directing the flow of instructions and data?
   A. Arithmetic and logic unit
   B. Registers
   C. Control unit
   D. CPU interconnections

2. Which generation of computers used vacuum tubes for digital logic elements and memory?
   A. First
   B. Second
   C. Third
   D. Later

3. Which of the following describes the accumulator (AC)?
   A. Contains the 8-bit opcode instruction being executed.
   B. Contains the address of the next instruction pair to be fetched from memory.
   C. Holds temporarily operands and results of ALU operations.
   D. Specifies the address in memory of the word to be written from or read into the memory buffer register (MBR).

4. Operands for arithmetic and logic operations are presented to the ALU in _____.
   A. input devices
   B. registers
   C. output devices
   D. the processor

5. What is -18_{10} in sign-magnitude notation?
   A. 10010010_2
   B. 10010011_2
   C. 00010010_2
   D. 00010001_2

6. One of the elements in machine instruction that specifies the operation to be performed is referred to as _____.
   A. result operand reference
   B. source operand reference
   C. operation code
   D. next instruction reference

Continued...

7. Which of the following is the instruction field that corresponds to basic elements of the instruction?
   A. Opcode, Program Counter
   B. Opcode, Register
   C. Opcode, Operand Reference
   D. Only opcode

8. *"Every computer will have a set of instructions. One of the instructions is involved with movement of data into or out of register or memory locations."* Referring to the given statement, which instruction type is involved?
   A. Data processing
   B. Data storage
   C. Control
   D. Data movement

9. The method of accessing units of data in which a word is retrieved based on a portion of its contents rather than its address is referred to as _____ method.
   A. associative
   B. random access
   C. sequential
   D. direct

10. Which of the following is a form of read-only memory?
   A. Optical
   B. Magnetic surface
   C. Magneto-optical
   D. Semiconductor

Continued...

SECTION B: STRUCTURED QUESTIONS (40 Marks)

Instruction: *Answer **ALL** questions in this section. Write your answers in the answer booklet provided.*

QUESTION 1 (10 Marks)

a) Given that the PC contains 211, the address of the first instruction, and the partial list of opcodes as shown in Figure 1:

i. Illustrate the execution of the subsequent **FIVE** instructions from memory content in the diagram (211, 212, 213, 214 and 215).

ii. Show the contents of the registers (Program Counter - PC, Accumulator - AC, and Instruction Register - IR).

[5 Marks]

Memory content	
211	1373
212	6375
213	5372
214	6374
215	2375
...	...
372	5151
373	16DA
374	0B2C
375	0123
...	...

Partial list of opcodes	
0001	Load AC from memory
0010	Store AC to memory
0101	Add to AC from memory
0110	Subtract memory from AC

Figure 1. Memory content and partial list of opcodes

b) Convert 282.375_{10} into binary. Show the steps to get the answer. [1 Mark]

c) Convert 635.347_{8} into hexadecimal. Show the steps to get the answer. [1.5 Marks]

d) Using 8-bit two's complement, calculate $56_{10} - 108_{10}$. Show the steps and verify the result. [2.5 Marks]

Continued...

QUESTION 2 (14 Marks)

a) Given the following expression,

$$Z = (B * C / D) * (F + A * E)$$

i. Convert the expression to postfix notation. [1 Mark]

ii. Write the following machine instructions:

- Zero-address [1 Mark]
- One-address [2 Marks]
- Two-address [1 Mark]

iii. Draw the stack diagram that illustrates the program execution. [1.5 Mark]

b) A computer system has a memory architecture made up of main memory of 45TB and cache of 400KB. In order to perform an efficient mapping function, the main memory is arranged in blocks of 128 bytes.

Draw the address structures for different mapping functions as stated below. Indicate the fields and the number of bits required for each field.

i. Direct Mapping [1.5 Marks]

ii. Eleventh-Way Set Associative Mapping [1.5 Marks]

iii. Associative Mapping [0.5 Mark]

QUESTION 3 (10 Marks)

a) Describe **THREE** differences between sequential access and random access of computer memory. [3 Marks]

b) What is a system bus? Explain **TWO** characteristics of each of the following types of system buses.

i. Data bus

ii. Address bus

iii. Control bus [7 Marks]

Continued...

QUESTION 4 (10 Marks)

a) List **THREE (3)** categories of external devices and give at least **TWO (2)** examples of each. [3 Marks]

b) Given **FIVE (5)** instructions where each instruction has **FIVE (5)** stages (FI, DI, CO, EI and WO) with delays of 5, 3, 2, 7 and 3 seconds for each stage respectively.

i. Draw a timing diagram for instruction pipeline operation. [4 Marks]

ii. Calculate the *total processing time* and *throughput* for the implementation of pipelining and non-pipelining.
[Note: Please write the formula that is appropriate to use] [3 Marks]

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